REMARKS

In the amendments above, Claims have been amended, and Claims 19 to 23 have been cancelled, to more particularly point out and distinctly claim Applicant's invention.

Co-pending U.S. patent application Serial No. 09/694,429 is mentioned on the enclosed form PTO-1449. A copy of the application itself is also enclosed.

Claims 13-18 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The Examiner's attention is directed to the amendments above, wherein Claim 13 has been amended.

Claims 1-4 and 9-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Hongo et al. '759 ("Hongo") and Haight et al., "MARS: Femtosecond Laser Mask Advanced Repair System In Manufacturing", J Vac. Sci. Technol. B 17(6) pp 3137-3143 (Nov/Dec 1999) ("Haight"), and Claims 1-5 and 9-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Hongo and Haight in view of Lou et al. '272. Claims 1-4 and 9-18 have been rejected under U.S.C. § 103(a) as being unpatentable over Hongo and Haight in view of Gelbart et al. '818; Claims 1-4, 9-13, 16 and 16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Hongo and Haight in view of Zhang et al., "Study Of Microprocessing Of Glass...", Proc. SPIE vol. 3933 pp. 332-337 and Okamoto '606; and Claims 1-4, 6-12 and 19-23 have been rejected under 35 U.S. C. § 103(a) as being unpatentable over James et al. '200 combined with Hongo and Haight in view of Jansen et al. '718.

Applicant respectfully traverses the above rejections.

Hongo et al. teach the processing of photomasks to remove defects where the laser beam passes through the transparent substrate. However, the backside irradiation described herein is of nanoseconds duration, which is five orders of magnitude greater than femto-second lasers' technology. In atomic relaxation times, nanoseconds time durations are considered as nearly continuous, and therefore constitute a completely different field.

The slight reduction of thermal effects at below 20 nanoseconds is known to be orders of magnitude larger than femto-seconds' laser induced damage zones, and that is well described in the Haight et al. paper.

Moreover, in contrast to Haight et al. where a method of ablation of chrome by femto-second laser describes the laser beam as being focused in air, and in accordance with the present invention, focusing a laser radiation through transparent media is accompanied by The Kerr effect with self-focusing inside the substrate. A damage zone inside quartz or fused-silica is created by nearly ten-fold more laser energy then what is required to ablate chrome off a surface.

Therefore, by reducing energy considerably, to a level of tens of nanojoules, at focus, no intra-volume scattering center is created on one hand, but a self-focusing which results in surface ablation microns away from focal plane, results on the other hand. Such self-focusing leads to the possibility of directing the laser beam many microns away from surface target, and achieving the desired pattern, with less debris and better control of damage zone size and shape.

Gelbart et al. teach ablation of material coating as a means for forming phase shift masks. In contrast, this application teaches intra-volume damage zone as a means to form phase shift masks. Phase shift elements are introduced inside the substrate itself, with no

ablation. The proposed optical elements form scattering centers within the transparent media.

Zhang et al. and Okamoto et al. teach ablation of material or coating as a means for forming grooves for phase shift masks, and phase shift forms due to index of refraction difference of air and substrate or coating and substrate, whereas the present application teaches intra-volume damage zones as a means for forming phase shift masks. Phase shift elements are introduced inside the substrate itself, with no ablation.

The method disclosed in the present invention would definitely not be obvious to a person skilled in the art familiar with Hongo, Haight, Gelbart et al., Zhang et al., and Okamoto et al. It should be noted that Claim 1 explicitly refers to the use of "ultra-short" laser irradiation.

In sum, the claims herein are not unpatentable under U.S.C. § 103(a) over any reference or combination of references cited by the Examiner. Therefore, the rejections under U.S.C. § 103(a) should be withdrawn.

Reconsideration and allowance of all the claims herein are respectfully requested.

Respectfully submitted,

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